

THE NESTING HABITS OF THE BURROWING BEE,
EPINOMIA TRIANGULIFERA VACHAL¹

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Epinomia triangulifera is a large bee, recorded heretofore, according to W. Dwight Pierce², from New Mexico, Kansas and Nebraska. In St. Louis it was found in large colonies on two clay hillocks in a vacant lot comprising a few acres in the heart of the city. These bees seem to have a strange liking for elevated areas, for in this sunny region, which was a favorite haunt of so many Hymenoptera, only these two colonies on the hillocks were found. For want of a temporary name, I called them the "knoll-bees," and was much interested to find that Mr. Pierce had been impressed with the same characteristic, for he also records having found them in colonies and on elevations "a foot or so above the surrounding ground."

On the gentle slope of a knoll, a few nests of this species were seen during the warmer months of three years. On September 1 of the fourth year, 1918, when this spot was examined, they were found in enormous numbers. The conditions which obtained in that place or year must have been exceptionally favorable to this species, in order to produce so many. The most densely populated portion was the area sloping gently toward the southwest, although the level portions of the hill-top were also abundantly occupied. This region was covered with grass of a wiry nature, growing sparsely on the clay soil, with occasional patches entirely barren. Both amidst the grass and on the uncovered areas their domes of excavated earth were to be seen; in

¹ Identified by J. C. Crawford.

² Univ. Nebr. Stud. 4: 29. 1904.



Fig. 1. Nesting Site of the Knoll-bee, *Epinomia triangulifera*.
Fig. 2. Nests of Knoll-bee.

the grassy areas the vegetation helped to anchor the loose soil and hold the little hills intact over their burrows. Figure 1 shows their domes among the sparse grass.

In another area, perhaps a hundred yards away, on a plateau left by the artificial cutting down of a high embankment, they also occurred in great abundance in that year. This plateau, about six feet above the surrounding surface, had a slight southward slope, the same as the first locality. The population of bees inhabiting this small elevation was of especial interest. Four years previously, in the early spring, this embankment had been graded down and the yellow clay hauled away for use elsewhere. Every season thereafter, I frequently scanned the newly exposed soil of this plateau in search of data upon the succession of insect life that would take possession of it. The first and second summers gave no vegetation, (this suggests how heavy and impenetrable was the soil, if even seeds and grasses could not take hold upon it), and besides a few turreted spiders, grasshoppers and cicindela beetles, nothing was seen to nest upon it. In the third year, the parent stock of the present population migrated thither from the other knoll one hundred yards to the north. Considering the enormous increase and the flourishing condition of this immigrant population, we are justified in concluding that the conditions which characterized this spot must have been precisely to their pleasure and advantage, and therefore we may justly accept this as their characteristic habitat, although we have seen them in only few localities. Especially on the northern portion of this plateau, in an area about twenty-five feet square, the nests were so abundant that one could not step anywhere without trampling upon them. In fact, it often happened that three to five nests were so close together as to have one large, spreading mound to cover them all, and in one area only one yard square, I actually counted two hundred and sixty nests of these bees. Figure 2 shows seven nests and a coin (American ten-cent piece) to show the relative size. The task of digging must have been great in this heavy clay, for the amount of soil was enormous. When one looks upon the work of a colony of these bees, one cannot help thinking that they, like the earth-

worms, are active agents in working over the soil.

The openings into the burrows are not exposed, but each is completely covered by its mound of loose soil. Sunflowers abounded in this region, and the returning bees were heavily laden with golden pollen, not only on the legs, but on the under side of the abdomens as well. Close examination of specimens later revealed that there were rows of hairs on the abdomen and legs, the purpose of which is readily apparent.

A returning bee has little difficulty in finding her burrow, and alights upon it without hesitation or orientation. She does not kick away the soil to make an opening as do certain wasps; in fact, I doubt if her heavily laden condition would permit her to do so, but she immediately pokes her head into the loose soil of the mound, and with a few mysterious pushes, wriggles through somehow, without for an instant uncovering the burrow.

On September 1, the date when I discovered the large population in 1918, the mounds were inspected at noon, but, although they were watched for an hour, no life was seen about them. At three o'clock when I returned, many of the bees were on the wing bringing in pollen. A few were not so laden, but out of about one hundred counted in one area, only three were seen returning to the nest empty-handed; however these might have been still occupied with burrowing. One nest was opened after one of these unladen mothers had entered; the digging was indeed a task, for the yellow clay was gummy and unyielding. The burrow was $\frac{3}{8}$ inch in diameter, and went down straight into the ground for 17 inches. In the bottom was the mother bee, but no cell was there: the burrow was not yet quite ready for pollen. I was not at hand when the excavating was going on, but, as mentioned before, they work close together in a small circumscribed area, and they may possibly use for nidification the burrows from which they emerge.

It rained all of September 2, and when I examined the nests the next day, I found that all the little hills of loose soil had been washed smooth and packed down over the nests, and the openings had not yet been uncovered. One bee

with her heavy load of pollen was trying to effect an entrance to one of the holes. Whether she had been away from home during the storm and was just now returning, I do not know. The following night it rained again, and my next examination three days later, showed that they were making but slow progress in resuming activities; scarcely more than one-tenth of them had then been able to escape from their temporary imprisonment. From this it is at once apparent that rains are really a serious impediment to the work of this species, even more than we see in the cases of some of the burrowing wasps, as *Bembix mubilipennis* and others, which scramble out uninjured almost as soon as the storm-clouds have blown away. May there be some correlation between this greater liability to injury in heavy rains and their habitual choice of high knolls for nesting sites? In three or four places on the ground were little masses of pollen which the females had lost in their extreme efforts to gain entrance to burrows closed by the rain.

The next day the sun shone and there was a slight increase in activity, but in some portions of the field it appeared that there had been heavy mortality. On this occasion I made one more attempt at digging up nests. In following one, it was necessary to dig out a space about a foot across, and in so doing I broke into five other nests. I could follow only one of these channels, however; it went straight down for 24 inches, and the worker was at the bottom. Three inches above the terminus was a lateral cell filled with golden pollen and containing a very young larva.

In the area of the colony where the hill-top had recently been cut away, the nests occurred in abundance on the top and some were very close to the edge of the sharp declivity, but there were none at all on the steeply sloping side. Since all of the burrows went straight down, some of the nests near the edge, although they were placed at a proper depth below the top, had very little protection of soil on the side.

By September 12, the nests had almost regained their normal proportions, and one could hardly see that the rains had played havoc. The great majority of the bees had been able to dig out of their temporary prisons. When I visited

Bee-city the next morning at nine o'clock, I was surprised to find almost all nests wide open and heavily laden mothers entering them. These bees made no effort to keep the holes closed either in their absence or presence as they had so constantly done before, probably because the soil had been washed away. Only a few nests were still covered; perhaps these contained lazy or sleepy bees. This was my first visit to the colony so early in the morning. The afternoons had always found the nests covered, and likewise on this day, at five o'clock the holes were all covered as usual, with the exception of perhaps a half-dozen which had probably lost their proprietors through disaster. The problem remains whether they close them to exclude the mid-day heat, or open them for a morning airing, or for some other reason. One frequent reason for closing or guarding the entrance to wasp or bee burrows is the annoyance of parasites. The only enemies observed lurking about here were a few *Philanthus punctatus* females, but they were not actually seen to enter the holes. These wasps seek bees for prey, but I am very doubtful that they would venture to attack healthy bees three times as large as themselves.

Thus they flourished in bliss unalloyed for a few days until the next rainy spell came in the latter part of September. Meanwhile their progress in provisioning their cells must have been great, for the surrounding region was full of sunflowers and autumnal composites, which brought their supplies of food near to hand. Great quantities of white snakeroot also grew near by, but I did not at any time see the bees carrying white pollen, although in two or three cases they were seen feeding upon the flowers.

The autumn rains again flattened the mounds of the knoll-bees and covered the burrows with sticky clay as before, and caused a permanent stoppage of activities. Days passed, and I waited for them to reappear, but they did not. Either they were so old that they could not again dig themselves out, or this late date practically marked their three-score and ten. A very, very few stragglers were seen later, but in the few nests which were excavated each was the tomb of its maker.